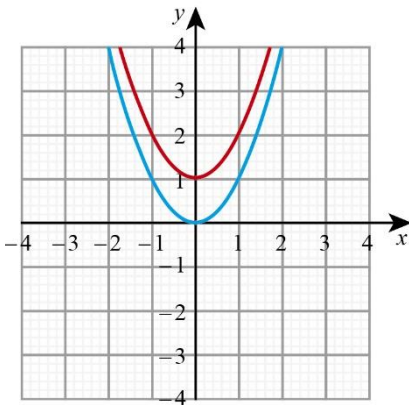
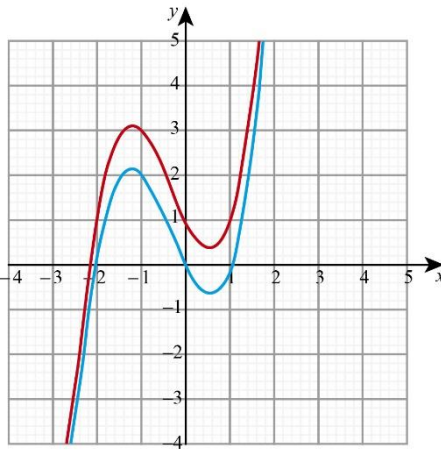


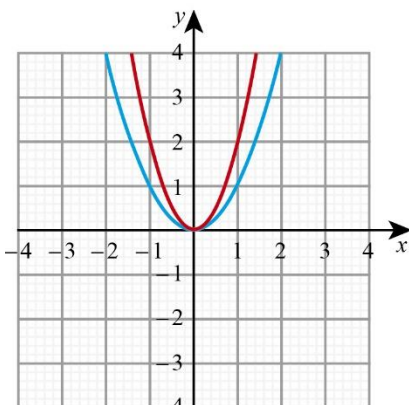
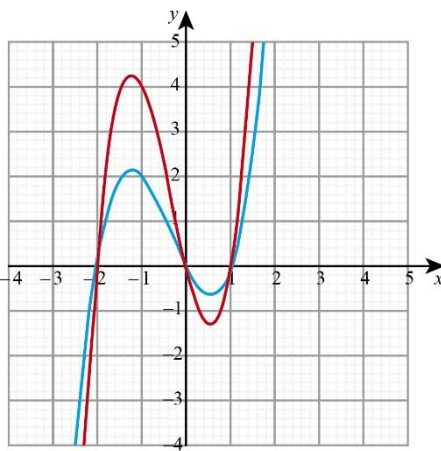
2 Functions

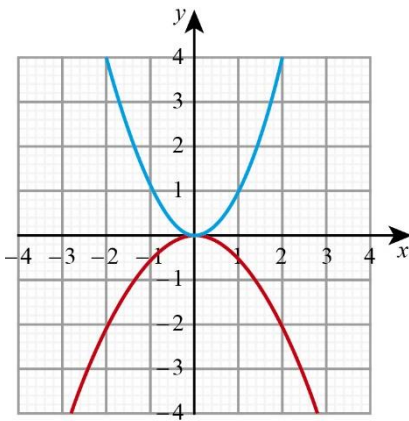
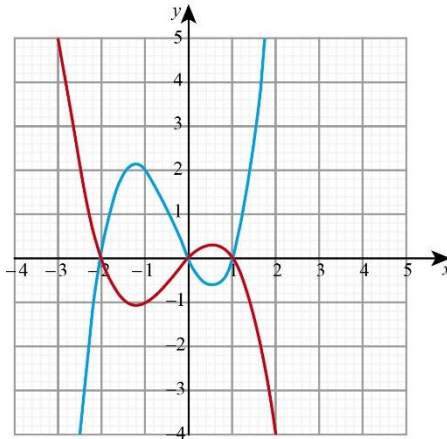
Activity: Transformations of functions (Teacher version)

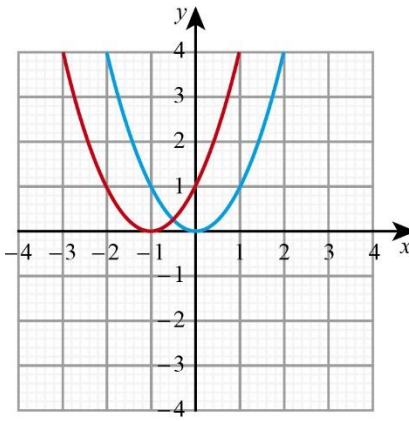
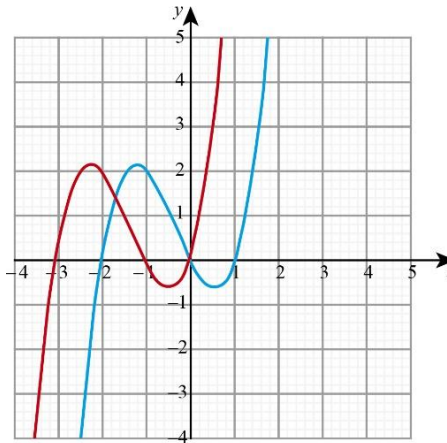
The original graphs of $f(x) = x^2$ and $g(x) = x(x - 1)(x + 2)$ are shown in each graph below.

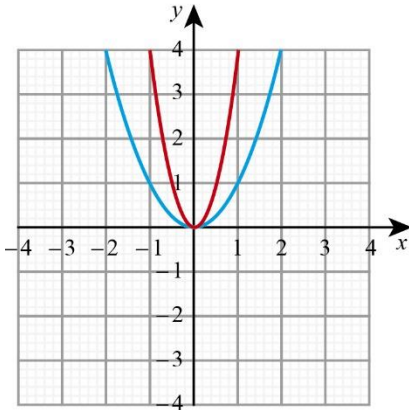
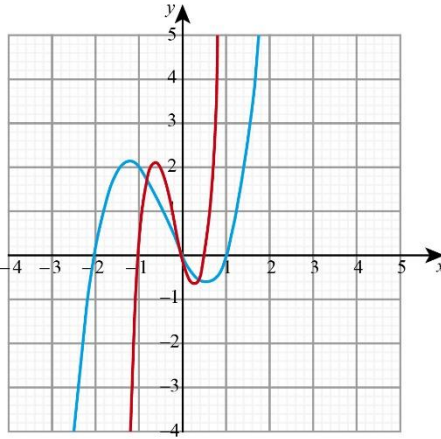
- On the same set of axes, sketch BY HAND (without your GDC) the transformed graphs of $y = f(x)$ and $y = g(x)$ given in the left-hand column.
- Label the coordinates of any important points.
- Check to see if your sketches are correct by CHECKING on your GDC (again, try to think about it and do it by hand at first).
- Describe and explain the general transformation in the row below.

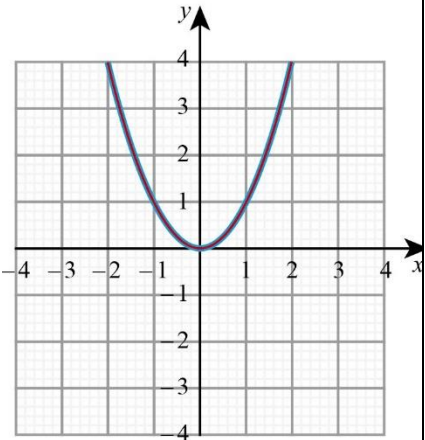
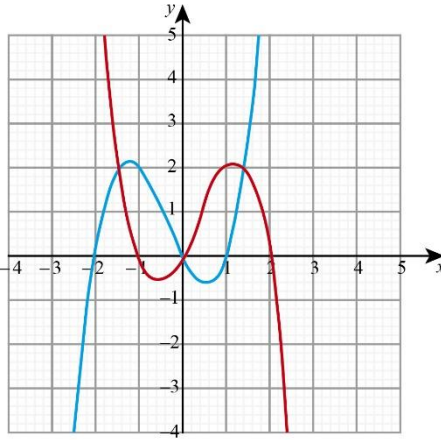
Specific transformation description	Transformed graph of $y = f(x)$	Transformed graph of $y = g(x)$
$y = f(x) + 1$ $y = g(x) + 1$		
Description of general transformation with a brief explanation	$y = f(x) + c$ translates the graph c -units vertically on the y -axis because all the y -values are changed by c .	

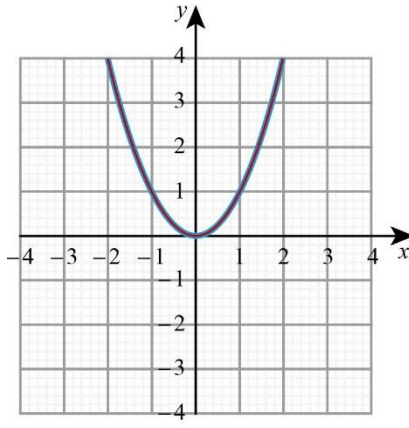
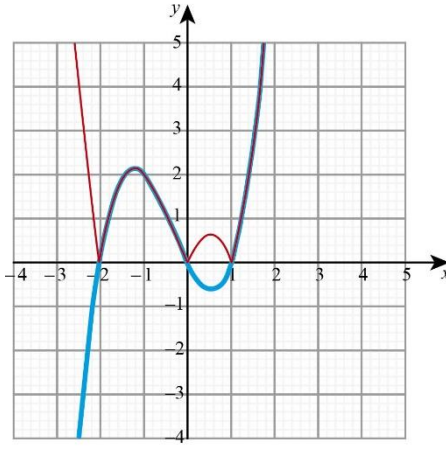
Specific transformation description	Transformed graph of $y = f(x)$	Transformed graph of $y = g(x)$
$y = 2f(x)$ $y = 2g(x)$		
Description of general transformation with a brief explanation	$y = af(x)$ vertically dilates (stretches) the graph of $y = f(x)$ by a scale factor of a .	

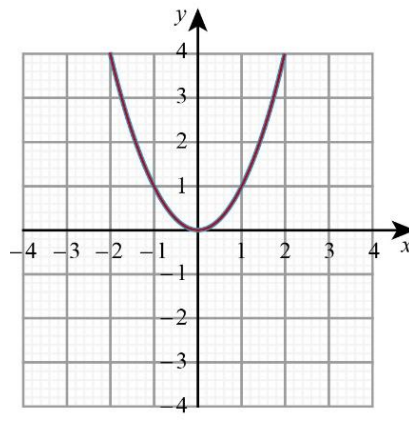
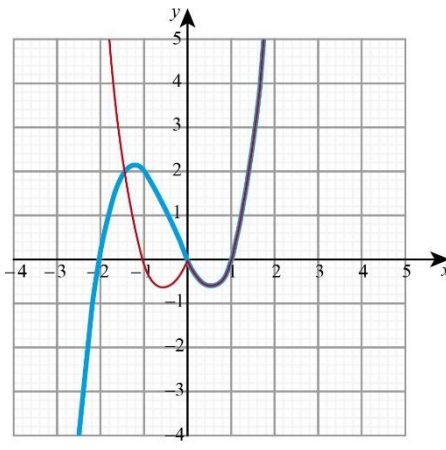
Specific transformation description	Transformed graph of $y = f(x)$	Transformed graph of $y = g(x)$
$y = -\frac{1}{2}f(x)$ $y = -\frac{1}{2}g(x)$		
Description of general transformation with a brief explanation	<p>$y = af(x)$ vertically dilates (stretches) the graph of $y = f(x)$ by a scale factor of a.</p> <p>(NOTE: for this graph, the stretch factor is $\frac{1}{2}$, which is actually a vertical compression.)</p> <p>If $a < 0$, graph is also reflected in the x-axis.</p>	

Specific transformation description	Transformed graph of $y = f(x)$	Transformed graph of $y = g(x)$
$y = f(x + 1)$ $y = g(x + 1)$		
Description of general transformation with a brief explanation	<p>For $y = f(x + c)$, the graph is translated horizontally '$-c$' units. This relates directly to all x-intercepts. The reason is that if you plot an (x, y) point, you use the value not from $y = f(x)$ but rather from $y = f(x + c)$ and plot $(x, f(x + c))$.</p>	

Specific transformation description	Transformed graph of $y = f(x)$	Transformed graph of $y = g(x)$
$y = f(2x)$ $y = g(2x)$		
Description of general transformation with a brief explanation	For $y = f(bx)$, the graph is stretched horizontally by scale factor $\frac{1}{b}$. The reason is that if you plot an (x, y) point, you use the value not from $y = f(x)$ but rather from $y = f(bx)$ and plot $(x, f(bx))$.	

Specific transformation description	Transformed graph of $y = f(x)$	Transformed graph of $y = g(x)$
$y = f(-x)$ $y = g(-x)$		
Description of general transformation with a brief explanation	For $y = f(bx)$ when $b < 0$, the graph is reflected in the y-axis. The reason is that if you plot an (x, y) point, you use the value not from $y = f(x)$ but rather from $y = f(-x)$, which is on the opposite side of the y-axis, and plot $(x, f(-x))$.	

Specific transformation description	Transformed graph of $y = f(x)$	Transformed graph of $y = g(x)$
$y = f(x) $ $y = g(x) $		
Description of general transformation with a brief explanation	<p>For $y = f(x)$, the graph is the same when $f(x) > 0$ and is reflected in the x-axis when $f(x) < 0$. This is because all of the y-values which were negative are now positive (since it is the absolute value).</p>	

Specific transformation description	Transformed graph of $y = f(x)$	Transformed graph of $y = g(x)$
CHALLENGE: $y = f(x)$ $y = g(x)$		
Description of general transformation with a brief explanation	<p>For $y = f(x)$, the graph when $x > 0$ is unchanged. However, when $x < 0$, the graph when $x > 0$ is reflected in the y-axis. The reason is that if you plot an (x, y) point, you use the value not from $y = f(x)$ but rather from $y = f(-x)$, which is on the opposite side of the y-axis, and plot $(x, f(-x))$.</p>	

Specific transformation description	Transformed graph of $y = f(x)$	Transformed graph of $y = g(x)$
CHALLENGE: $x = f(y)$ $x = g(y)$		
Description of general transformation with a brief explanation	<p>This is simply the inverse of $y = f(x)$, which is a reflection in the line $y = x$.</p>	

Specific transformation description	Transformed graph of $y = f(x)$	Transformed graph of $y = g(x)$
PUTTING IT ALL TOGETHER: $y = -2f(2(x+1)) + 1$ $y = -2g(2(x+1)) + 1$		
Description of general transformation with a brief explanation	<p>Following the order of transformations:</p> <ol style="list-style-type: none"> 1 Vertical dilation by scale factor 2 and a reflection in the x-axis 2 Horizontal dilation by scale factor $\frac{1}{2}$ 3 Horizontal translation -1 units and vertical translation $+1$ units. 	